Psychosocial Factors and Their Relationship to Type-2 Diabetes Mellitus Outcome Among the Strong Heart Study Cohort

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PSYCHOSOCIAL FACTORS AND THEIR RELATIONSHIP TO TYPE-2 DIABETES MELLITUS OUTCOME AMONG THE STRONG HEART STUDY COHORT

by

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ABSTRACT

Psychosocial Factors and Their Relationship to Type-2 Diabetes

Mellitus Outcome Among the Strong Heart Study Cohort

by

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Diabetes mellitus is a serious problem that affects 15.7 million individuals in the United States. The complications of this disease are catastrophic and can lead to blindness, kidney disease, lower limb amputations, nerve damage, increased risk of heart disease, stroke, and death. Among Native Americans, diabetes has reached epidemic proportions. A variety of psychosocial variables has demonstrated relationships to diabetic outcome. Past research has shown a relationship between psychological variables and glucose control. The current study of Native Americans shows a similar pattern using the psychosocial instruments to measure the constructs of depression, anger, hostility, social support, and perceived stress. Participants for this study were part of the Strong Heart Study and were 512 Native Americans from tribes in South Dakota and Oklahoma between the ages of 46 - 77. This study shows a relationship between the variables of anger, depression and hostility, and glyciemic control. A relationship between social support, perceived stress, and depression was found to be related to reported quality of life in participants who were either diabetic or had impaired glucose tolerance.

(86 pages)

DEDICATION

For my grandmother,

Patricia Anne Kougl

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Brian O'Leary

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CHAPTER I

PROBLEM STATEMENT

While AIDs, heart disease, and cancer are often mentioned as the plagues of the century, another disease that should always be included on the list is diabetes mellitus. Not only is it a leading cause of death and disability, but it has also been calculated to account for one seventh of the cost of health care in the U.S. (Bell, Summerson, & Konen, 1995). According to the American Diabetes Association (ADA; 2000a), there are 2,200 individuals who are diagnosed with diabetes every day. Diabetes has been estimated to affect 6.6% of the total U.S. population (Goetch & Wiebe, 1998). Native American tribes, however, have been found to have significantly higher prevalence of diabetes. In 1980, it was estimated that there were 204 diabetes-related deaths per 100,000 in the Indian Health Service (IHS) population compared to 10.1 deaths per 100,000 of all other races in the U.S. (Gohdes, 1986). What is more alarming is that before 1940, diabetes was almost unknown among Native Americans (West, 1974). Not only is the overall rate of diabetes high among native populations, the complications associated with diabetes appear to impact this population more than the general diabetic population. The rate of diabetic end stage renal disease (kidney failure) is 6 times higher among Native Americans (ADA, 2000b). Native Americans also have a 3 - 4 times higher rate of lower limb amputations compared to the general population (ADA, 2000b).

Psychosocial factors have been found to have an impact not only on diabetic outcome, but also on an individual's adherence to medical recommendations. Factors such as stress (Surwit & Schneider, 1993), social support (Erikson & Rosenqvist, 1993), and depression (Rubin & Peyrot, 1994) have all been found to have an influence on diabetic outcome and/or adherence. Further, hostility has been identified to be a psychosocial risk factor in other diseases, such as cardiovascular disease, that are related to diabetes (Smith, 1998).

Understanding the impact these factors have on individuals with diabetes not only allows us to better understand the disease, but also potentially allows us to improve this population's quality of life. While type-2 diabetes mellitus has been identified as a major threat among individuals with Native American ancestry, limited research has been conducted concerning psychosocial factors affecting this diabetic population. Therefore, this study will explore the relationship between psychosocial variables and diabetic outcome among Native Americans from two different geographical areas. The psychosocial instruments used in this study measure depression, social support, anger, perceived stress, and hostility. Two different types of measures were used to assess outcome. The first type consisted of three physiological glucose measures: HgA_{1c}, fasting glucose, and glucose tolerance. Those individuals with poorer glucose control will have elevated glucose measures. The second outcome measure is the Rand SF-36 health status survey, which reports the participants' perceived outcome on both physical and mental health constructs. Only those participants that have abnormal glucose control, based on the three physiological glucose measures, will be included in the second analysis.

CHAPTER II

LITERATURE REVIEW

Methods to Search for Material

The search for this review utilized the ERIC and Psychlit computer databases, entering the words of Native American, American Indian, Indian, Sioux, Cheyenne River, diabetes, diabetes mellitus, psychosocial, stress, depression, social support, Strong Heart Study, type-2 diabetes, and noninsulin-dependent diabetes mellitus. The reference lists attached to each article were also searched to find relevant articles.

Description of Diabetes Mellitus

Diabetes mellitus is a group of disorders that indicate a common defect in carbohydrate metabolism. It was first identified 2,000 years ago by Areteus, who discussed the sweet smelling urine of people with this disease. In the 19th century, two different types of diabetes were identified: one that appeared in childhood and was fatal, and one that appeared in obese people and could be treated with a proper diet (Surwit & Schneider, 1993). These are very similar descriptions to the two types of diabetes currently identified. Type-1 diabetes mellitus usually has an onset before the age of 30 and is characterized by an inability of the pancreas to produce insulin. It is thought to be caused by a viral infection or autoimmune disorder in genetically predisposed individuals that destroys beta cells in the pancreas. These individuals have to take insulin either orally or by injection in order to survive (Goetsch & Wiebe, 1998). Type-2 diabetes mellitus is caused by a person's tissue becoming insulin resistant and will not allow insulin to carry glucose across the cell membrane. Initially, there is an increase in insulin production by the body, but over time insulin levels may decrease because of pancreas exhaustion (Goetsch & Wiebe, 1998).

Complications Associated with Diabetes Mellitus

Diabetes, if left untreated or inadequately treated, can lead to significant health complications. If the body does not produce sufficient insulin (type-1 diabetes), it may begin to utilize proteins and fat as a source of energy. This may produce large amounts of ketoacids that may lead to a diabetic coma, which may result in death (Goetsch & Wiebe, 1998). As the duration of diabetes lengthens, complications usually begin to occur. Complications for both type-1 and type-2 diabetes can include retinopathy, which may lead to blindness; peripheral vascular disease, which in some instances leads to amputation; and kidney disease, which can lead to end-state renal failure and an increased risk of coronary heart disease and stroke (Bennett & Knowler, 1984). Erectile dysfunction afflicts 50 - 75% of diabetic men and tends to have an earlier onset than in the general population (Vinik & Richardson, 1998). While the onset of these complications is usually slow and silent, they are catastrophic outcomes that lead to either death or a significantly lowered quality of life. Because the brain utilizes glucose, severe hypoglycemia has been associated with permanent brain damage in some diabetic patients (Cox & Gonder-Frederick, 1992).

Diabetic Treatment and Management

Diabetic management depends on several factors such as the type of diabetes, age of onset, and how serious the glucose levels are fluctuating. One of the primary focuses of diabetes management for all individuals with diabetes is maintaining blood sugar within the normal range (Goodall & Halford, 1991). To do this, individuals diagnosed with type-2 diabetes are strongly encouraged to follow a strict calorie-controlled diet that is low in fat and high in fiber and to exercise on a regular basis. Because obesity has been found to be one of the primary causes of type-2 diabetes, a controlled diet and regular exercise are key in this diabetic regimen. Physical activity has been found to be associated with increased insulin sensitivity, a change in resting metabolism due to tissue change, and improved glucose tolerance. It also prevents further weight gain because of increased energy expenditure and has also been associated with appetite suppression in obese individuals (Harris, Caspersen, DeFriese, & Estes, 1989). Unfortunately, many individuals find dietary regulation and regular exercise to be very difficult to maintain, especially if it involves changing life-long patterns. In some cases of type-2 diabetes, individuals may be required to take insulin injections several times a day to regulate glucose levels. Depending on the individual, this can be very complex as the person's activity and glucose levels may change often and rapidly. Oral hypoglycemic medications also have been found useful in management of type-2 diabetes (Goodall & Halford, 1991).

Stress has been found to be a factor that may not only interfere with adherence to a diabetic regimen, but has also been found to have a direct influence on blood glucose levels. Stress has been found to cause an inhibition of insulin secretion. At the same time, stress can promote the conversion of fat to free fatty acids, which will promote the conversion of glycogen to glucose in the liver (DeAtkine, Surwit, & Feinglos, 1991).

Epinephrine, which is released at higher levels during periods of stress, has been found to increase insulin resistance (Goodall & Halford, 1991). Major life events, both good and bad, that produce stress have been found to result in poorer control of glucose levels (Schwartz, Springer, Flaherty, & Kiani, 1986). Human studies have shown a relationship between stress and hyperglycemic response. For example, individuals from both groups of diabetes were found to have a clear hyperglycemic response to undergoing an elective surgery (Peyrot, Mcmurry, & Kruger, 1999). Additionally, daily subjective stress has been found to have a negative impact on glycemic control (Brantley & Jones, 1993) and diabetic children with type A behavior patterns have demonstrated a hyperglycemic response to stress (DeAtkine et al., 1991).

It has also been suggested that certain "at risk" groups for type-2 diabetes may have the same autonomic nervous system abnormalities that have been identified in animal models (Surwit & Schneider, 1993). For example, young Pima Indians with normal glucose levels showed a disturbed gycemic response to behavioral stress compared with a Caucasian sample. In this study both groups were given a mixed meal and then were exposed to a 10-minute stressor 2 hours later. Ten of 13 Pima subjects showed a hyperglycemic response to the stressor while 7 of the 8 controls did not. Another study found differences in sympathetic nerve activity between Pima Indians and Caucasians. While stress is a difficult concept to measure, many people with diabetes strongly believe that stress influences their disorder.

Psychosocial Factors and Adherence

One of the most difficult obstacles in the management of diabetes is adherence to the diabetic regimen. While adherence to a prescribed regimen is a problem with most chronic illnesses, it is more of an issue with diabetes because of its often complex nature, the potential problems associated with noncompliance, and the benefits associated with compliance. Compliance with the diabetic regimen may be poorer than with other chronic diseases. Small changes in a person's behavior can be frustrating for any normal person. The diabetic regimen requires changes in a person's diet and activity level, both of which can be very difficult to change under the best of circumstances. The regimen is not only complex, but it is life long, which makes it even more difficult. One study of 60 diabetic participants found that 60% did not administer their insulin correctly, 73% did not follow their prescribed diets, and 50% did not properly care for their feet (Rosenstock, 1985). Only 7% of patients in one study complied with all the steps in their diabetic regimen (Rosenstock, 1985). Other studies have suggested that medication recommendations are usually followed, but lifestyle changes such as diet and exercise are usually not practiced (Cox, & Gonder-Frederick, 1992).

Many factors have been thought to make it more difficult for a person to sustain their adherence to a regimen. The initial diagnosis of any chronic disease has been found to create emotional reactions that can reach clinical levels of mood and anxiety disturbance (Rubin & Peyrot, 1994). Depression can reduce an individual's ability to adhere to a regimen. Further, it has been suggested that depression and hyperglycemia may exacerbate each other at the neuroendocrine level (Rubin & Peyrot). Regardless of whether the depression was caused by being inflicted with a chronic illness or not, it has been found that identifying and treating depression improves compliance (Leichter & Archer, 1991). Depression has also been found to be related to poor glucose control in

Northern Plains Native Americans. Daniels et al. (1999) found that depression predicted poor glycemic control as measured by HgA_{1c} levels in an IHS clinic. Other behavioral and emotional problems have been associated with recurrent diabetic ketoacidosis. It has been suggested that physicians look at a person's mental health if a patient's history has many medical crises (Rubin & Peyrot, 1994). The presence of an eating disorder is sometimes found among diabetic patients, and behaviors related with eating disorders such as severe calorie restriction, binge eating, and purging may be detrimental or life threatening to a diabetic patient. This is thought to be especially common in young female type-1 diabetic patients. One of the most alarming findings is the use of insulin manipulation as a form of weight control (Rubin & Peyrot).

Family conflict and dysfunction are predictive of adherence difficulty. Conversely, improvements in interpersonal relationships and family life have been found to correlate with improved compliance (Cox & Gonder-Frederick, 1992). It has also been suggested that codependent relationships that develop because of diabetes may be related to treatment failure. This involves another family member reinforcing the diabetic to not follow the regimen and maintain the relationship by remaining "incompetent" about diabetes-related issues (Leichter & Archer, 1991). Another important relationship that has received very little attention from researchers is the patient-physician relationship. It has been found that many diabetic patients who do not receive frequent checkups, rather than it being a result of health costs or distance, the patient avoids them because of a lack of interest in receiving advice from his/her physician (Cox & Gonder-Frederick, 1992). Lack of motivation to follow a regimen has also been identified as a key factor in noncompliance. Often diabetic patients may not believe that diabetes is a serious illness.

Whether this is due to a lack of education concerning diabetes or a patient's denial of having a chronic illness, the result is the same, noncompliance. A study looking at diabetics' views of their illness found that compliant individuals viewed diabetes to be very serious compared to individuals with poor compliance, who did not think diabetes was serious (Alogna, 1980). Even when individuals understand the seriousness of diabetes, they may not believe that they have any control over the disease. Low self-efficacy has been thought to predict poor adherence with many chronic diseases, especially diabetes. Even if individuals believe in a health recommendation, they may not comply because of the belief that it is too difficult for them to follow (Rosenstock, 1985). This is further complicated because adherence to a regimen does not guarantee a good outcome. Severely obese individuals face an even greater motivational dilemma. The prospect of controlling weight is difficult for many healthy individuals and may seem overwhelming for obese individuals (Rubin & Peyrot, 1994).

Locus of control (LOC) has been found to be a predictor of compliance in outcome studies. Individuals with an internal LOC have a high regard for their health, but those individuals with an external LOC are more likely to follow doctor's recommendations and have more positive health practices in terms of following their diabetic regimen. This finding has been found in middle-aged men with diabetes (Alogna, 1980). Lack of financial resources has also been found to correlate with poor adherence to a recommended regimen, presumably because they cannot afford the frequent medical attention, medications, and supplies required for proper diabetic care (Leichter & Archer, 1991). Foods that are recommended for a diabetic diet have been described as too expensive by some groups of patients with diabetes (Lang, 1985). This is especially true for large families that have limited resources. Individuals with diabetes who are dependent on others for their care often will not admit to such difficulties because they do not want to embarrass their care takers or because they fear that they may be placed in a nursing home (Leichter & Archer, 1991).

Overall, compliance with a diabetic regimen is difficult under the best of circumstances. There are many adherence barriers that make compliance unlikely. Health care professionals may find it necessary to help the diabetic individual deal with these adherence barriers if treatment is going to be followed. Many of these adherence barriers are found in Native American populations where significantly higher prevalence rates of type-2 diabetes have been discovered.

Type-2 Diabetes Mellitus Among the Native American Population

Over the last 30 years, Native Americans have been confronted with growing rates of diabetes that have reached epidemic dimensions. Historically, diabetes has not been a problem faced by Native Americans. In 1928, the Prudential Insurance Company published an article indicating that diabetes was thought to be rare in Native Americans (cited in West, 1974). Review of medical reports of physicians serving Native Americans in Oklahoma between 1832 and 1939 does not indicate any prevalence of diabetes (West). The rarity of diabetes prior to 1940 is found among the Plains Indians, Eskimos, and Polynesian peoples. Cases of diabetes began to show up in the 1940s among Native people. By 1954, diabetes started to show moderately high rates among the Pima Indians. At the same time, diabetes was still fairly rare among the Ute and Apache tribes (West).

In 1964, West estimated that 25% of Cherokee Indians in North Carolina over the age of 30 had diabetes. Data collected by IHS showed that between 1972-74, there were 104 diabetes-related deaths per 100,000 among Native Americans in Oklahoma; however, not all tribes were affected to the same extent. For instance, during this same 3-year period, there was not a single diabetes death among Alaska Indians or Eskimos. Total visits to IHS medical facilities found that over one tenth of all visits were diabetes related. In the 45 - 65 age group, 60% of visits were diabetes related in 1975. The Aberdeen IHS region, which primarily serves the Lakota and Dakota Sioux Tribes, found that visits for diabetes-related problems were also very high during this period. The number of outpatient diabetes-related visits in IHS facilities rose from 58,901 in 1971 to 156,213 in 1983 (Gohdes, 1986). Deaths related directly to diabetes mellitus among the Cheyenne River Sioux Tribe of South Dakota were 46.1 per 100,000 during 1990 - 1993. This is higher than the average diabetes-related death rate of the IHS regions as a whole. During the same period of time, the diabetes-related death rate for all races of the U.S. was 11.8 per 100,000 (Huffstetter, 1998).

There are several factors that have been suggested as potential causes for the higher prevalence rates of diabetes among Native Americans. Type-1 diabetes remains extremely rare among Native Americans. Type-2 diabetes, which usually develops after the age of 30, has been found to afflict a large percentages of certain tribes. Obesity has been known to be a risk factor for developing type-2 diabetes for over 200 years. In 1915, a detailed medical description written on the Southwestern Indians stated that "pathological obesity does not exist." Early photographs taken of different Native American groups also indicate a very low prevalence of obesity (West, 1974). This is not true today. The Sioux were nomadic hunters that followed the buffalo before the West was settled. All food came from either wild game or plant foods native to the plains region (Lang, 1985). When the tribes were confined to reservations, they became dependent on government rations that consisted of green coffee, dried tea, sugar, flour, salt pork, and beef. This demonstrates a shift from a diet high in fiber and unrefined carbohydrates to a diet high in refined carbohydrates and sugar and low in fiber. In 1985, government "commodity" foods were consumed in 85 - 90% of the households on one Sioux reservation. Commodities include canned meat, vegetables, fruits packed in syrup, macaroni, rice, vegetable shortening, flour, sugar, and peanut butter (Lang). Healthy foods are often considered not only to be very expensive but also considered unfamiliar and disliked. Medical personnel have found the typical Sioux Indian's diet to be high in protein, fat, and carbohydrates, with an underrepresentation of vegetables and fresh fruits. While many individuals from various tribes have attributed diabetes to "white man's food," it is ironic, but not surprising, to find a reluctance to change current eating habits to conform to a diabetic regimen. Lang found in a Dakota (Sioux) diabetic population that most individuals had received diabetic and dietary education and could repeat it back, in detail, to the interviewer. Yet, most openly stated that they did not follow the prescribed diet. This is consistent with the mainstream population of individuals with diabetes who find changes in lifestyle difficult. Further, the activity level of many Native Americans has been thought to be far less than that of their ancestors, which could also attribute to the current high levels of obesity.

There seems to be a very strong genetic predisposition for type-2 diabetes. Studies show concordance rates as high as 90 - 100% between monozygotic twins developing diabetes (Goetsch & Wiebe, 1998). Native Americans are the only minority that has to prove tribal membership (minority status) by their blood degree. Without a documented blood degree, an individual cannot be a tribal member or receive the services he/she is entitled to by treaty with the U.S. government. This documentation of blood degree has allowed researchers to look at the prevalence rates of individuals with different percentages of Native American ancestry. A study that sampled an adult Cherokee population in North Carolina found an increased prevalence rate of diabetes among individuals who had a Cherokee blood degree of 50% or more compared to other tribal members of a lesser blood degree. Another study by Lee et al. (1995) also found that the prevalence rate of diabetes significantly increased when participants had a blood degree of 50% or higher in tribes of three different states. Further, among individuals in the Fort Berthold IHS region, those with less than a 50% Native American blood degree have the same prevalence of diabetes as the general U.S. population (Brosseau, Eelkema, Crawford, & Abe, 1979). Similar findings have been found among the Pima and Papago Indians (Knowler, Williams, Pettitt, & Stienberg, 1988). These findings suggest a strong hereditary tendency among certain Native American groups for type-2 diabetes.

Adherence barriers have been found among the Sioux that can significantly decrease diabetic adherence. One of the first is obtaining adequate medical care. While many Native Americans have access to free health care, at times this health care may be limited by funding considerations. The physician-patient relationship is also significant when discussing Native American populations. Depending on the individual and the medical doctor, this relationship can vary in effectiveness. Many Native Americans do not feel as if they have a choice in terms of selecting their doctor because they have to take whoever is available at the IHS facility in order to receive free medical attention. If the doctor is not sensitive to cultural issues, the Native patients may fail to seek medical attention. Individuals of full Native American heritage have been found to make fewer clinical visits than Native Americans of mixed blood or the general U.S. population (Brosseau et al., 1979). Another factor is the load placed on the resources of tribal clinics. It is not uncommon for individuals to wait 8 hours to be seen at a clinic, and sometimes even have to come back the next day. Men, who often tend not go to the clinics as frequently as women, often give up their place in line in order for women and children to be seen first (M.A. O'Leary, personal communication, December 10, 1998). Sioux patients frequently do not ask medical personnel very many questions becausee it is considered disrespectful to do so. At times this may lead to misunderstanding and the resulting noncompliance with treatment. The Sioux separate what is "traditional" and "modern" medicine. While diabetes is often considered to be a "white man's disease" and needs modern medicine, the use of traditional medicine is often preferred over modern medical interventions. Disease is often thought to be a side effect of disharmony among all things, including the body, mind, and spirit. Some medicine men among the Sioux have claimed to be able to treat "sugar" or type-2 diabetes, but have made discontinuing "white medicine" a prerequisite for treatment (Lang, 1985).

Another cultural factor that can influence compliance is that many Indian cultures look at the present and not the future. The issues of today are dealt with first and if these issues continue, little attention is paid to future consequences. This type of cultural feature does not work well with a diabetic regimen when short-term rewards are few and far between. Socioeconomic factors must also be taken into account when treating Sioux patients with diabetes. Some reservations have as high as a 90% unemployment rate. In 1990, 59.7% of all individuals living on the Cheyenne River Sioux Reservation were living below the poverty line. South Dakota had a statewide unemployment rate of 4.35%, while the Cheyenne River Sioux Reservation had an unemployment rate of 27.9%. During the same period on the same reservation, 24% of Sioux households did not have a vehicle, 44% did not have a telephone, and 7% did not have indoor plumbing (Huffstetter, 1998). These factors, combined with the fact that many members live up to 90 miles from an IHS medical facility, make it difficult to keep follow-up appointments or even return phone calls.

Depression is another adherence barrier that Native Americans face. Native Americans as a group have some of the highest incidences of suicide attempts and completion (Huttlinger, 1995). Between 1990 and 1992, deaths due to suicide were 11.4 per 100,000 in the U.S. population, while the rate was 16.2 per 100,000 across all IHS facilities. During the same period, there were 45 suicide-related deaths per 100,000 on the Cheyenne River Sioux Reservation. Alcoholism, which can impair an individual's judgment about concerning diabetes care (Zielke, 1999) and create other medical problems, is quite common on certain Indian reservations. In all U.S. races, it has been calculated that there are 6.8 cases per 100,000 of severe alcoholism versus 56.5 per 100,000 on the Cheyenne River Sioux Reservation (Huffstetter, 1998). Depending on how a researcher defines "alcoholism," these rates could be substantially higher.

Certain beliefs about health and body weight may also influence adherence. On the Cheyenne River Sioux Reservation, many elders talk about tuberculosis (TB) and the devastating effect it had on the Sioux population (M.A. O'Leary, personal communication, December 10, 1998). It was noted that those who were thin seemed to be more susceptible to developing and dying from TB. Losing weight has been associated with sickness. One study looking at Sioux people with diabetes found that 12 of 19 individuals who received recommendations to lose weight disagreed with the doctor's recommendation, stating their weight was "alright" (Lang, 1985). It has recently been found that diabetes and end state renal disease (ESRD) put Native Americans on the Pine Ridge Sioux Reservation at a higher risk for developing TB. The rate of TB on this reservation is 9 times that of the U.S. population (Mori, Leonardson, & Welty, 1992), ESRD disease, which can be caused by diabetes, has steadily increased on Sioux reservations over the last 20 years. The total U.S. population with ESRD as a result of diabetes has been found to 5.8 times higher than among Caucasians (Newman, Marfin, Eggers & Helgerson, 1990).

IHS has recognized diabetes as a major health problem for Native people and has made efforts to initiate diabetic education and treatment programs on reservations across the U.S. (Stracqualursi, Rith-Najarian, Hosey, & Lundgren, 1993). These programs have been modeled after guidelines set forth by the World Health Organization (WHO), which includes three levels of treatment and prevention. The primary stage includes increasing fitness and decreasing obesity within a community. These programs have been in place for several years, but their success has not yet been determined. Secondary prevention includes screening members in the community for undiagnosed diabetes and preventing the development of complications in identified diabetic patients. Tertiary prevention attempts to lower the rates of mortality of those individuals with complications. These different levels of treatment and prevention are still ongoing and under refinement. It is unclear what degree of impact they will have in lowering the prevalence of diabetic complications and mortality (Gohdes, Schraer, & Rith-Najarian, 1996).

Summary

Diabetes is a serious problem among Native Americans. Even with IHS programs designed to educate and prevent diabetes and free medical care, the rates of complications from type-2 diabetes mellitus are alarming. Psychosocial variables have been shown to impact the outcome of diabetes both in the course of the disease itself and in the success of compliance to a diabetic regimen. Overall, very little research has been done pertaining to how depression relates to diabetes. There were several reviews that mentioned how depression can affect both the course of diabetes and adherence rates, but few could cite actual studies. Many of these reviews seemed to be basing this conclusion on clinical experience. Hostility was not mentioned in the diabetic literature reviewed, but has been shown to increase the risk of cardiovascular disease (Smith, 1998). This factor may be an important predictive variable in the outcome of type-2 diabetes as it has been for cardiac events due to the stress it places on the vascular system. The factors of stress and social support have clearly been demonstrated to have a relationship to diabetic outcome and adherence in the mainstream population. Overall, there have been only limited studies that reported the relationship between different psychosocial variables and type-2 diabetes among a Native American population.

Given that diabetes is a major health concern among Native people and that there has been very little research among this population on how psychosocial factors affect diabetic variables, the purpose of this study was to answer the following questions:

Hypothesis 1. What are the differences, if any, of the South Dakota group of participants versus the Oklahoma group on the glucose measures, quality of life, and the psychosocial measures? It is hypothesized that because of different environment conditions such as social economic status and a more rural environment that the South Dakota group will yield different psychosocial and quality of life scores than the Oklahoma group. The glucose measures are not expected to be statistically different.

Hypothesis 2. What is the relationship between the psychosocial factors of depression, anger, hostility, social support, and perceived stress with diabetic glucose-control? It is hypothesized that worse functioning on the psychosocial instruments will correlate with worse diabetic control as measured by the HgA_{1c} test, the 2-hour oral glucose tolerance test, and the fasting glucose test.

Hypothesis 3. What is the relationship between the psychosocial factors of depression, anger, hostility, social support, and perceived stress with perceived physical health and overall mental health outcome in individuals with abnormal glucose tolerance? It is hypothesized that worse functioning on the psychosocial instruments will correlate with poorer perceived outcome in both physical health and mental health.

CHAPTER III

METHOD

Strong Heart Study

The Strong Heart Study was initiated in 1988 to study cardiovascular disease among different Native American groups across diverse regions after it was determined that there was very little existing data describing these subgroups. The objective of the Strong Heart Study is to

> employ standardized methodology to estimate cardiovascular disease mortality and morbidity (incidence and prevalence) rates as well as to allow comparison of cardiovascular disease risk factor levels among American Indian groups living in three different areas: central Arizona, Southwestern Oklahoma, and the Aberdeen area of North and South Dakota. (Lee et al., 1990, pp. 1143)

The study using a cross-sectional approach allows for the correlation between not only cardiovascular risk factors and the prevalence of heart disease, but also for these same risk factors and diabetes. The Strong Heart Study has three primary components, a mortality phase, a morbidity phase, and a clinical examination. For the purposes of this study, the data from the clinical examination gathered in Phase II of the study will be utilized. The purpose of the clinical examination was to gather data on the prevalence rates of angina, myocardial infarction, cerebrovascular disease, hypertension, congestive heart failure, diabetes, and impaired glucose tolerance. This information is to be compared not only to other studies from different populations, but also within the study across the three centers and measured risk factors of each (Lee et al., 1990, p. 1143). The clinical examination from both the first and second phases consisted of a personal interview and a physical evaluation (Howard et al., 1998). The personal interview assessed areas such as family health history, dietary information, activity levels, current health status, and demographic information. The physical examination included measures to assess both cardiac and diabetic status as well as overall health (Lee et al., 1990). Strong Heart staff were centrally trained and evaluated in data collection, interviewing techniques, and form completions as described in the Strong Heart Study Manual. Procedures were taught and demonstrated by an instructor, and all staff had sufficient time to practice and demonstrate their competence at the procedures (Lee et al.). All personnel with access to data collected for the study were required to sign a confidentiality pledge and collected data were stored in a secure location (Lee et al.). The data used in this study were collected during Phase II of the Strong Heart Study (Lee, Welty, & Howard, 1993).

Participants

The Strong Heart Study population consists of resident tribal members of the following tribes: Pima/Maricopa/Papage Indians of central Arizona who live in the Gila River, Salt River, and Ak-Chin Indian communities; the seven tribes of Southwestern Oklahoma (Apache, Caddo, Comanche, Delaware, Fort Sill Apache, Kiowa, and Wichita) and the Oglala and Cheyenne River in South Dakota; and the Spirit Lake Tribe in the Fort Totten area of North Dakota (Howard et al., 1998). Communities within tribes were selected because they were considered by the tribe to be representative of the population in life-style, employment, education, and other sociodemographic factors as well as having the facilities to conduct the examination. While the Pima/Maricopa in

Arizona and the Sioux tribes in the Dakotas live on reservations in nonurban environments, the Oklahoma tribes live among the general population. Another difference was that many of the individuals in the Oklahoma tribes utilized their own private health care providers (Lee et al., 1990). Other criteria for the clinical examination included residing in the study communities, and being 45 - 74 years of age between July 1989 and June 1991 when the examination was conducted (Lee et al.). For participants to be eligible for future phases of the study, they must have been part of the original cohort. Retention rates for Phase II at the second physical examination averaged 89% (Howard et al., 1998). During Phase II, a pilot study was conducted in the Dakota and Oklahoma sites that introduced psychosocial measures that collected data on perceived stress, hostility, depression, social support, and cultural identification. There were 337 participants in the Oklahoma site and 172 participants in the South Dakota sites that were administered the measures, and they were selected in the order they were asked to complete the clinical examination (see Table 1; M.A. O'Leary, personal communication, June, 29 1999). The Strong Heart Study cohort consisted of 4,549 individuals aged 45 - 74 who were seen at the first examination (Phase I - 1989-1991). Only those that participated in the psychosocial pilot were included in the current study.

Participants for the current study were those individuals who participated in the psychosocial pilot study during Phase II of the Strong Heart Study. More females (343) participated than males (169) in the pilot study. The average age of participants in this study was 60 years of age with a range of 46 - 77 years of age. Education levels of participants ranged from 1 - 20 years of formal education, with participants as a whole having a mean formal education level of 11.90 years.

Table 1

Participant's Diabetic Status by Center

Group	Normal group	Impaired glucose tolerant group
All participants	186	30
Oklahoma center	123	214
South Dakota center	63	109

Note. Four participants were missing data on the diabetic status variable.

Procedures for Current Study

A formal request (see Appendix A) was submitted to the Strong Heart Study Steering Committee (SHSSC) for access to the data for the variables in Appendix B. The variables requested were from the Phase II data set (1992-1994), which is the most current data set ready for external analysis. The re-examination rates for those alive during Phase II of the study averaged 89% of the original sample (Howard et al., 1998). During the second phase of the Strong Heart Study, psychosocial factors were examined among 512 participants among the South Dakota and Oklahoma sites (see Appendix C).

Psychosocial Instruments

Center for Epidemiological Studies--Depression Scale

The Center for Epidemiological Studies--Depression Scale (CES-D) scale was used to measure the concept of depression. The CES-D was developed to represent four dimensions of depression: negative affect, positive affect, psychsomatomotor distress, and interpersonal relations (Beeber, Shea, & McCorkle, 1998). The same instrument has been used in research on healthy, physically ill, and mentally ill populations in past studies (Carpenter, Hall, Ragens, Sachs, & Cunningham, 1998) The CES-D is a self-report instrument that assesses the presence and severity of depressive symptoms occurring over the past week. Respondents rate each item on a 4-point scale (0 = rarely or none of the time, 1 = some or a little of the time, 2 = occasionally or a moderate amount of the time, and 3 = most of the time). The CES-D takes approximately 5 minutes for a respondent who understands the instrument to complete (Carpenter et al., 1998). An overall score of 16 is generally considered the score at which the symptomology has reached clinical levels for this instrument (Radloff, 1977). The CES-D has been shown to have adequate test-retest reliability: .54 for internal consistency, .85 for the general population, and .95 for a clinical population (Radloff). The internal reliability (Cronbach's alpha) of the CES-D is .89 (Lee et al., 1993; refer to Appendix D for a copy of the CES-D).

Cook and Medley Hostility Scale

The Cook and Medley hostility scale (Ho) was used to assess hostility. It consists of 8 true or false items that ask questions such as "it is safe to trust nobody" or "most people lie to get ahead." The participants were told that they were going to be asked about what they think about other people. The Ho is designed to measure cynical beliefs and mistrust of others, which is a construct that has been found to be a predictor of heart disease in some populations (Lee et al., 1993). The Ho scale has an internal consistency of .86, and a test-retest correlation after 1 year of .85 (Lee et al.; refer to Appendix D for a copy of the CM).

Spielberger's Anger Expression Scale

Spielberger's Anger Expression Scale (Spielberger's AX) was also used in the pilot study. This scale was designed to determine how people usually react or behave when they feel angry or furious. It differentiates between experienced and expressed feelings of anger (Lisspers, Nygren, & Soderman, 1998). The original scale consists of 19 items on a 4-point Likert scale (1 - 4, almost never - almost always). This instrument is reported to be highly valid among the studies it has been used on (Lisspers et al., 1998). Internal consistency (alpha coefficient) of the 20-item AX scale and the 8-item anger-in and anger-out subscales range from .73 to .84 (Lee et al., 1993; refer to Appendix D for a copy of the Speilberger's AX).

Interpersonal Support Evaluation List

The Interpersonal Support Evaluation List (ISEL) is a 21-item instrument that was used in the pilot study in order to assess social support. It asks questions about what the participants would do in emergencies, when they need money, who they can talk to about personal issues, and self-esteem related questions. The participants responded on a 4-point scale that range from "never true" to "definitely true." They were told that the statements may or may not be true for them and to respond appropriately. The ISEL has been found to have good test-retest reliability, ranging from .67 - .84, and the internal reliability of the total ISEL is .88 - .90 (Lee et al., 1993; refer to Appendix D for a copy of the ISEL).

Perceived Stress Scale

The Perceived Stress Scale is a 14-item scale designed to measure the degree to which situations in one's life are perceived as stressful. Seven questions of the Perceived Stress Scale were used to assess stress in the personal interview form 2 during Phase II of the Strong Heart Study (Lee et al., 1993). Respondents rate each item on a 5-point scale (0 = not at all, 1 = rarely, 3 = sometimes, 4 = often, and 5 = most of the time). Established norms for the Perceived Stress Scale are not applicable because only half of the instrument was used. The Perceived Stress Scale appears to be internally reliable, with reported coefficient alphas of .84, .85, and .86 among different populations (Cohen et al., 1983; refer to Appendix D for a copy of the personal interview form 2).

Dependent Variables

RAND 36-Item Short-Form Health Survey

The RAND Corporation originally developed the RAND 36-item Short-Form Health Survey (SF-36) for the Medical Outcome Study (MOS; Ware, 1993). The SF-36 contains 36 questions that cover eight areas: physical functioning, role limitations due to physical problems, social functioning, bodily pain, general mental health, role limitation due to emotional problems, vitality, and general health perception. It was designed as a self-administered questionnaire and usually takes about 10 minutes to complete. One of the limitations of this instrument when administered in the South Dakota site was the fact that many of the participants spoke Lakota as their first language and the instrument was translated to them. The SF-36 is considered by many in the medical community as the standard for measuring perceived quality of health status, and has been widely used in outcome studies. The SF-36 does not yield a total score, but rather weighted subscores for each of its domains. Each subscore has a range of 0 - 100, with a higher score indicating a more favorable health status. The SF-36 also yields two composite scores in the areas of physical health (PCS) and mental health (MCS). These scales were designed to better summarize the subscales of the SF-36. They have been shown to have reliability coefficients of .93 for the PCS and .88 for the MCS (Ware, 1994). It is these composite scores that were used in the current study. This instrument was used to assess each participant's perceived quality of life (refer to Appendix D for a copy of the RAND 36-item Short-Form Health Survey).

Hemoglobin A_{1c}

The measure of hemoglobin A_{1c} (Hg A_{1c}) is a widely used laboratory test to determine overall long-term blood glucose control. It measures the average blood glucose over a 2- to 3-month period preceding the test. Glycosylation is defined as the glucose that has attached itself to the hemoglobin portion of the red blood cell (South Dakota Diabetes Control Program, 1999). The process is irreversible. Because the life span of the red blood cell is typically 120 days, the test reflects glycemic control for a 2- to 3-month period. Normal values for this test range from 4 - 7%. IHS standards of care consider a value of 7 or greater to be an indicator of poor glycemic control (L. Best, personal communication, September 9, 2000). This test is commonly used and preferred among practitioners managing people with diabetes (South Dakota Diabetes Control Program, 1999).

Other Glucose Measurements

Two different glucose tolerance tests were used. The fasting glucose test is a simple blood test done after fasting for 8 hours. The oral glucose tolerance test is a measurement taken 2 hours after the participant was given a drink containing 75 g of anhydrous glucose dissolved in water. The cutoff for both tests is a lab value of less than 126 mg/dl. Scores above this suggest diabetes. If the score is between 110 and 126 mg/dl, the subject is considered to have impaired glucose tolerance and is at risk for developing diabetes mellitus (South Dakota Diabetes Control Program, 1999).

Analysis

Hypothesis # 1

Independent group t tests were performed to compare glucose levels, psychosocial variables, and the SF-36 composite scores for those participants who lived in South Dakota and Oklahoma. Only those participants with abnormal glucose tolerance or diabetes mellitus were included in the SF-36 comparison.

Hypothesis # 2

Multiple regression was used to determine if there was a relationship between each of the psychosocial factors and the three glucose tolerance variables. This was done both as an entire data set and also by region in order to determine if there were differences between the two groups.

Hypothesis #3

Multiple-regression was used to determine if there was a relationship between each of the psychosocial factors and the SF-36 physical health composite score and the mental health composite score. Because the SF-36 was being used as a diabetic dependent measure, only those participants who had either impaired glucose tolerance or diabetic were included in this analysis.

CHAPTER IV

RESULTS

Hypothesis #1

Glucose Control Dependent Measures

Descriptive statistics for each of the three glucose control measures were computed for all participants and also by state of residence. Overall, the mean glucose measures for all participants in the study reflected a high prevalence of glucose intolerance. The criterion for diagnosis of diabetes for the fasting glucose test was $>$ 126 mg/dl according to the guidelines set by the American Diabetes Association (South Dakota Diabetes Control Program, 1999). The overall mean score of the participants was 138.4 mg/dl. The 2-hour glucose mean score was 166.7 mg/dl. While the fasting glucose and 2-hour glucose tests were direct measures of a person's glucose levels, HgA_{1c} measured the average glucose levels over a 3-month period. The HgA_{1c} mean of 6.35 falls below the recommended cutoff ≥ 7, but corresponds to 120 mg/dl average over a 3-month period (South Dakota Diabetes Control Program, 1999). Overall, 63.4% of the 512 participants fell either in the impaired glucose tolerance category (110-125 mg/dl) or actually met criteria for a diagnosis of diabetes mellitus.

Difference Between South Dakota and Oklahoma Participants

Independent group t tests were performed comparing the means of the glucose control measures for those participants who live in South Dakota (SD) and those who live in Oklahoma (OK; see Table 2). Results indicate that for fasting glucose, the mean for

Table 2

Descriptive Statistics for Dependent Measures: Glucose Control

Dependent measure	N	Mean	SD
All HgA_{1c}	500	6.35	2.0
SD HgA_{1c}	167	6.33	2.0
OK HgA_{1c}	330	6.33	1.95
All 2-hour	365	166.78	80.22
SD 2-hour	126	163.57	81.79
OK 2-hour	238	168.93	79.35
All fasting glucose	502	138.40	65.36
SD fasting glucose	171	146.08	73.59
OK fasting glucose	328	133.75	59.12

Note. "All" = all subjects in the data set; SD = participants who reside in South Dakota; OK = participants who reside in Oklahoma.

the SD group (146.08) was statistically significantly different from that found in the OK group (133.75), t (497) = -2.029, $p < .006$, indicating a greater degree of glucose intolerance in the SD group. Other comparisons were not significant.

Quality of Life Dependent Measures

Descriptive statistics for each of the SF-36 composite scores were computed for all participants, and also by state of residence. Only those participants who had impaired glucose tolerance or a diagnosis of diabetes mellitus were included in the sample. The PCS for all participants was 42.55, which is comparable to the established norms (41.52) for people with type-2 diabetes in the general population (Ware, 1994). The MCS for all participants (53.66) was also comparable to the established diabetic type-2 SF-36 norms (51.90). See Table 3.

Table 3

Descriptive Statistics for Dependent Measures: SF-36 Subscale and Composite Scores

Dependent measure	N	Mean	SD
All PCS	260	42.55	9.73
SD PCS	80	40.35	9.98
OK PCS	178	43.58	9.50
All MCS	260	53.66	8.55
SD MCS	80	48.76	9.38
OK MCS	178	55.86	7.21

Difference Between South Dakota and Oklahoma Participants on the SF-36

Independent group t tests were performed comparing the mean scores on the SF-36 composite scores between those living in SD and those living in OK. Only those individuals with abnormal glucose tolerance were included (having either impaired glucose tolerance or diabetes). Results indicate that the PCS mean score for the SD group (40.35) was similar to that found in the OK group (43.58), $t\ (256) = 2.485$, $p < .777$. Comparison of the MCS between the participants in the two states showed that the SD group (48.76) was significantly lower than the OK group (55.86), $t\ (256) = 6.641$, $p < .000$, indicating a poorer perceived mental health quality of life in the SD group.

Psychosocial Measures

Several of the psychosocial instruments were modified after initial field trials, mainly because some recruiters and participants believed that some items were either inappropriate or not easily understood. As a result, many of the scores are not comparable to the established norms of the instruments. The mean score for all participants on the CES-D (11.61), which was administered in its entirety, as well as individuals for both SD (14.11) and OK (10.40) participants, was higher than the established norms (9.25; Radloff, 1977). It should be noted that the mean score for SD approached the established clinical cutoff score of 16 for the CES-D. The mean score for all participants for the Cook and Medley Ho scale was 3.59. Not all items of the Cook and Medley Ho scale were administered during the Phase II exam, so comparisons to national norms were not feasible. The Spielberger AX yielded three scores for all participants: Total (56.11), Anger-in (34.19), and Anger-out (12.92; Spielberger et al., 1976). Overall, the participants' scores for the Spielberger AX were higher than that of the national norms (46.30 for males, 48.05 for females), indicating a somewhat higher rate of anger expression (Spielberger et al., 1976). The mean scores for the Interpersonal Support Evaluation List were 50.75 for all participants, 47.55 for SD and 52.35 for OK. The protocol used in Phase II of the Strong Heart Study for these instruments was modified, so comparisons with established norms were not possible. The mean score for the items taken from the Perceived Stress Scale was 16.27 for all participants, 18.97 for SD participants and 14.83 for OK participants. Because not all items were used, national normative comparisons were not available. See Table 4.

Difference Between South Dakota and Oklahoma Participants on Psychosocial Variables

Independent group t tests were performed comparing the mean psychosocial scores between groups from SD and OK. Participants in SD reported a higher rate of

Table 4

Descriptive Statistics for Psychosocial Measures: Center for Epidemiological Studies--Depression Scale, Cook and Medley, Spielberger's AX, Interpersonal Support Evaluation List, Cultural Factors Questionnaire, and Perceived Stress Scale

Psychosocial measure	N	Min	Max	Mean	SD
All CES-D	465	0	57.0	11.61	9.15
SD CES-D	151	0	57.0	14.11	9.97
OK CES-D	311	0	57.0	10.40	8.49
All CM	48	0	8.0	3.59	2.38
SD CM	161	0	8.0	4.09	2.44
OK CM	317	0	8.0	3.34	2.31
All AXtotl	494	38.0	72.0	56.11	5.62
SD AXtot	167	38.0	70.0	56.32	5.96
OK AXtot	327	38.0	72.0	56.00	5.47
All anger-in	497	18.0	45.0	34.52	4.1
SD anger-in	167	21.0	41.0	34.19	4.68
OK anger-in	327	24.0	45.0	34.71	3.87
All anger-out	499	8.0	29.0	12.92	3.42
SD anger-out	167	8.0	29.0	13.21	3.65
OK anger-out	329	8.0	29.0	12.76	3.29
All ISEL	481	25.0	28.0	50.75	7.93
SD ISEL	161	25.0	60.0	47.55	8.22
OK ISEL	317	27.0	60.0	52.35	7.28
All prestress	502	7.0	32.0	16.27	5.02
SD prestress	169	7.0	28.0	18.97	4.49
OK prestress	330	7.0	28.0	14.83	4.69

depression than those in OK, t (460) = -4.157, $p < .007$. On the ISEL, the OK group reported higher levels of perceived social support than those in SD, t (476) = 6.511, $p < .017$. The OK group scored slightly higher on the Spielberger AX anger-in subscore than those in SD, t (492) = 1.323, p < .025. The participants' scores on the other psychological instruments were not statistically different from each other.

Overall, there were differences between the SD and OK groups. Among the glucose measures, only the fasting glucose was statically significantly different, with the SD group having a slightly higher mean than the OK group. While the overall percentage of participants that fell into the impaired glucose tolerance group was the same for both groups, the SD group did have more outliers than the OK group. On the SF-36, only those participants that fell in the impaired glucose tolerance group were included in the comparison. The results were similar for both groups on the PCS, while the SD group scored significantly lower on the MCS, indicating a poorer perceived mental health quality of life. Participants in SD reported higher depression scores and less social support than the OK group as measured by the CES-D and ISEL. The OK group did report a slightly higher rate of keeping anger in rather than expressing anger than the SD group. Other psychosocial scores were similar between the two groups.

Hypothesis #2

Analysis of Relationship

What is the relationship between the psychosocial factors of depression, anger, hostility, social support, and perceived stress on glucose control? It was hypothesized that worse outcomes on the psychosocial instruments would correlate with the HgA_{1c} test, the 2-hour glucose loading, and the fasting glucose measures, indicating that poor glycemic control was associated with worse psychological functioning. It was also speculated that there was a relationship between psychosocial variables and glucose control among those individuals with normal glucose tolerance. Separate stepwise multiple regression analyses were conducted on all participants and on those who had abnormal glucose tolerance.

All Participants--Glucose Control

Three separate stepwise multiple regression analyses were conducted to examine the relationship between the psychosocial variables (CES-D, ISEL, AXtot, AXin, AXout, CM, and perceived stress) and glucose control measures HgA_{1c}, 2-hour glucose, and fasting glucose (see Table 5). For HgA_{1c}, the regression was statistically significant, $F(1, 440) = 3.940$, $p < .048$. The Cook Medley was the only measure to load ($R = .094$, $p < .048$). The 2-hour glucose regression was also statistically significant, $F(1, 331) = 4.144$, $p < .043$, with the CES-D being somewhat related to the 2-hour glucose levels ($R = .111$, $p < .043$). Additionally, the fasting glucose regression was statistically significant $(1, 440) = 5.252$, $p < .022$, with the CES-D again loading into the regression ($R = .109$, $p < .022$; see Table 6). While these are statistically significant relationships, the actual amount of variance accounted for was quite modest.

Abnormal Glucost Tolerance--Glucose Control

Three separate stepwise multiple regression analyses were conducted to examine the relationship between the psychosocial variables (CES-D, ISEL, Axtot, Axin, Axout, CM, and perceived stress) and the glucose control measures HgA_{1c}, 2-hour glucose, and fasting glucose among those with impaired glucose tolerance or diabetes mellitus. For HgA_{1c}, the regression was statistically significant, $F(1, 277) = 4.540$, $p < .034$, the anger-in construct loading in the regression ($R = .127$, $p < .034$; see Tables 7 and 8). The

Table 5

Regression Models Using Psychosocial Scales as Predictor Variables and the Glucose Control Variables as a Dependent Measure for All Participants

Model	Source	SS	df	MS	F
HgA_{1c}					
Cmtot	Regression	15.847	1	15.847	3.940*
	Residual	1769.793	440	4.022	
	Total	1785.641	441		
2-hour glucose CES-D	Regression	26417.849	1	26417.849	4.14*
	Residual	2110285.59	331	6375.485	
	Total	2136703.44	332		
Fasting glucose CES-D	Regression	22224.358	1	22224.358	5.25*
	Residual	1861841.44	440	4231.458	
	Total	1884065.80	441		

* $p < .05$.

Table 6

Multiple Regression Results for Predicting Glucose Dependent Using Psychosocial Variables

Dependent variable	Predicting variable	N	R	R^2	AdjR^2	R^2Change	Sig.
HgA_{1c}	CM	441	.094	.009	.007	.009	.048
2-hr glucose	CES-D	332	.111	.012	.009	.012	.043
Fasting glucose	CES-D	441	.109	.012	.010	.012	.043

Table 7

Regression Models Using Psychosocial Scales as Predictor Variables and the Glucose Control Variables as a Dependent Measure for Participants with Abnormal Glucose Tolerance

Model	Source	SS	df	MS	F
HgA_{1c} Anger-in	Regression	22.124	1	22.12	4.540*
	Residual	1349.698	277	4.87	
	Total	1371.822	278		

*$p < .05$.

Table 8

Multiple Regression Results for Predicting Glucose Control in the Abnormal Glucose Tolerance Group Using Psychosocial Variables

Dependent variable	Predicting variable	N	R	R^2	AdjR^2	R^2Change	Sig.
HgA_{1c}	Anger-in	278	.127	.016	.013	.016	.034

regressions for the 2-hour glucose and the fasting glucose were not statistically significant, however, because the sample has been restricted, and the range of scores on the outcome variables has been reduced, making it more difficult to establish relations.

Hypothesis #3

What is the relationship between the psychosocial factors of depression, anger, hostility, social support, and perceived stress on perceived physical health and mental health outcome in individuals with abnormal glucose tolerance? It was hypothesized that worse outcome on the psychosocial instruments would correlate with poorer perceived outcome in both physical health and mental health.

Because the SF-36 was being used as a dependent outcome measure measuring diabetic functioning, regressions were only run on the abnormal glucose tolerance group. Two separate stepwise multiple regression analyses were conducted to examine the predictive ability of the psychosocial variables in predicting the perceived physical health and mental health outcome in a group of participants with either impaired glucose tolerance or diabetes mellitus (see Tables 9 and 10). The PCS regression was statistically significant, $F(1, 233) = 5.677$, $p < .018$, with less social support predicting participants to perceive poorer physical health ($R = .155$, $p < .018$). The MCS regression was significant in two models. In the first model, $F(1, 233) = 90.92$, $p < .000$, the CES-D loaded ($R = -.531$, $p < .000$), suggesting the increased depressive symptoms decrease an individual's overall mental health quality of life. In the second model, $F(1, 233) = 60.612$, $p < .000$, both the CES-D and the perceived stress variables ($R = -.587$, $p < .000$) loaded into the regression equation. While these findings are statistically significant relationships, the actual amount of variance accounted for is quite modest.

Correlations Among Psychosocial Variables

The correlation matrix of psychosocial variables used in the analysis is presented in Table 11 in order to inspect for multicolinearity, which may have impacted the findings. An inspection of this matrix reveals noteworthy colinearity between the psychosocial variables. The CES-D correlates with the ISEL ($R = -418$, $p < .001$), the Cook Medly ($R = .327$, $p < 0.01$), the Perceived stress ($R = .449$, $p < 0.01$), and the anger-in score ($R = -.164$, $p < 0.05$). The anger and hostility scores also highly correlate,

Table 9

Analysis of Variance for Regression Models Using Psychosocial Scales as Predictor Variables and the SF-36 Composite Scores as a Dependent Measure for Participants with Abnormal Glucose Control

Model	Source	SS	df	MS	F
PCS, Model 1					
ISEL	Regression	9.325	1	9.325	5.677*
	Residual	381.104	232	1.643	
	Total	389.430	233		
MCS, Model 1	Regression	120.612	1	120.612	90.92**
CES-D					
	Residual	307.737	232	1.326	
	Total	427.349	233		
MCS, Model 2	Regression	147.424	1	73.712	60.612**
CES-D and					
Prestress	Residual	280.925	231	1.216	
	Total	428.349	233		

* $p < .05$, ** $p < .01$.

Table 10

Multiple Regression Results for Predicting the SF-36 Composite Scores as a Dependent Measure for Participants with Abnormal Glucose Control Using Psychosocial Variables

Dependent variable	Predicting variable	N	R	R^2	AdjR^2	R^2Change	Sig.
PCS	ISEL	233	.155	.024	.020	.024	.018
MCS	CES-D	233	-.531	.282	.278	.282	.000
MCS	CES-D and prestress	233	-.587	.344	.338	.063	.000

but over the four scores, three come from the Spielberger AX and all measure a similar construct. While the colinearity between the psychosocial variables was not unexpected, it does pose a potential problem when interpreting the regression analysis. This relation between the independent variables decreases the amount of unique variance accounted for by each when assessing relation to each of the dependent variables. Also found in Table 4 are the simple bivariate correlations between the psychosocial measures and the glucose control variables. The largest number of significant relationships are found with the fasting glucose measure, which is the most common measure used in diagnosing type-2 diabetes.

Table 11

Pearson Product Moment Correlation Matrix for Variables Used in Analyses

Variables	CES-D	ISEL	Axtot	Axin	Axout	CM	Prestress	PCS	MCS
CES-D	1.0	-.417**	.00	-.164**	.185**	.327**	.449**	-.065	-.522**
ISEL		1.0	-.015	.127**	-.096*	-.353**	-.253**	.147**	.312**
AXtot			1.0	.710**	.563**	-.086	.014	.034	-.112*
AXin				1.0	-.126**	-.225**	-.204**	-.019	.051
AXout					1.0	.115*	.232**	.077	-.200**
CM						1.0	.261**	-.047	-.132**
Prestress							1.0	-.038	-.455**
PCS								1.0	-.328**
MCS									1.0

Variables	HgA_{1c}	2-hour glucose	Fasting glucose
CES-D	.084	.11*	.109*
ISEL	-.196**	-.075	-.095*
AXtot	0.030	.054	.065
AXin	-.084	.037	-.038
AXout	.030	.008	.100*
CM	.094*	.088	.094*
Prestress	.045	.042	.094*
PCS	-.196**	-.095	-.224**
MCS	.016	-.001	-.027
HgA_{1c}	1.0	.558**	.822*
2-hour glucose		1.0	.575**
Fasting glucose			1.0

*$p < .05$, ** $p < .01$.

CHAPTER V

DISCUSSION

Hypothesis #1

While all of the participants in the Strong Heart Study are Native American, there are very distinct cultural and environmental differences between those participants in South Dakota and Oklahoma. The fasting glucose levels were significantly higher among South Dakota participants. Interestingly, 66% of the Oklahoma participants and 65.6% of the South Dakota participants fell within the abnormal glucose tolerance group. One would expect the percentage of participants in the abnormal glucose tolerant group to be somewhat higher than the mainstream prevalence rate of 6.6% (Goetch & Wiebe, 1998), but not to the extent found in the current study. While the higher fasting glucose levels in South Dakota could be interpreted as a greater degree of glucose intolerance, the fact the HgA_{1c} was not different between the two groups creates some confusion as to why this measure was elevated. HgA_{1c} is one of the most valid measures of glucose control because it is a cumulative measure across 3 months, versus fasting glucose, with a state measure of 24 hours. Other studies that have examined Strong Heart data have also found the rate of diabetes to be comparable between the South Dakota and Oklahoma centers (Lee et al., 1995). These rates are far higher than those found in the general population of the respective states. South Dakota has a diabetic prevalence rate of 3.6%, while Oklahoma is slightly lower at 3.4% (Center for Disease Control, 1997). The health implications for Native Americans in these two groups are staggering. It should be noted that these findings do not reflect the prevalence of diabetes in younger members of the tribes not included in this study.

Only those participants that were in the abnormal glucose tolerance range were included in the analysis of the RAND SF-36. This instrument was used to assess the participants' perceived quality of life in the areas of physical health and mental health. Overall, the physical health composite score was comparable with established norms for type-2 diabetes. It seemed that Strong Heart participants who fell in the abnormal glucose tolerance range perceived their physical health similar to people with diabetes in the general population. No statistical difference was found in the PCS between the two centers. Over all, participants reported a comparable MCS ($\underline{M}$ = 53.66) compared to the established SF-36 type-2 diabetic norms ($\underline{M}$ = 51.90). This finding indicated that those individuals with either impaired glucose tolerance or diabetes mellitus had a lower perceived mental health quality of life than those individuals who did not meet the criteria for impaired glucose tolerance or diabetes. This was consistent with other studies. Guttman-Bauman, Flaherty, Strugger, and McEvoy (1998) found that people with diabetes who maintained control of their glucose levels reported an overall higher quality of life than those who did not control their glucose levels on a different quality of life measure. South Dakota ($\underline{M}$ = 48.76) participants reported a significantly lower perceived mental health-related quality of life than the Oklahoma group ($\underline{M}$ = 55.86), which was similar to the findings of the worse psychosocial scores in South Dakota participants versus Oklahoma participants.

There were several differences between the results of the psychosocial measures between the South Dakota and Oklahoma sites. One of the most striking differences was on the CES-D. The depression scores for the South Dakota participants were especially alarming, because the mean (M = 14.11) approached the cutoff score of 16 that differentiated depressed from nondepressed individuals (Ranloff, 1977). The mean score on the CES-D for the Oklahoma participants was within the normal range (M = 10.40). There were several factors that may explain the discrepancy of scores between the two centers. Lower socioeconomic status and a more rural environment, characteristics at South Dakota reservations, might explain these differences. Both have been shown to contribute to a poorer mental health (American Psychological Association, 2000). On the other hand, there are no reservations for the Oklahoma tribes and many of the participants reside in urban areas. Additionally, the suicide rate for Native Americans in South Dakota is quite high, supporting the validity to the CES-D findings. These results are also consistent with the lower MCS reported by South Dakota participants.

Hypothesis #2

The second hypothesis of this study was that psychosocial variables, such as depression, anger, hostility, social support, and perceived stress, would predict glycemic control. Separate analyses were run for all participants and for only those participants with impaired glucose tolerance. This hypothesis was supported for the depression, hostility, and anger variables.

HgA_{1c} is often considered one of the best measures of glucose tolerance because it is a cumulative measure assessing of 3 months of glucose levels. When all participants were included in the regression, the hostility variable was related to HgA_{1c} levels. After the analysis was reduced to just those participants with abnormal glucose tolerance, it was found that the anger-in subscale was correlated with HgA_{1c}. Because the abnormal glucose tolerance group definition was based on glucose levels being above a certain level, the range was significantly reduced in this analysis. The actual amount of variance accounted for by these findings was quite modest, which may have reduced the amount of clinical usefulness that they can contribute.

This finding was different from results Daniels et al. (1999) found in a similar population, where depression was found to be related to the HgA_{1c} variable. Because depression was the only variable included in his study, it was not entirely possible to compare the results with the current study. Mazze, Lucido, and Shamoon (1984) also found a relationship between psychosocial variables and glycemic control. They found that by monitoring HgA_1 levels, they could predict changes in anxiety, depression, and quality of life scores. This is a different way to approach the psychosocial role in diabetes, but demonstrated a relationship nonetheless.

There was a high degree of multicolinearity between the hostility and depression variables ($\underline{r}$ = .327) in this sample. Considering Daniels and others' (1999) findings of a relationship between HgA_{1c} and depression, the high degree of multicolinearity between hostility and depression could indicate that a similar phenomenon has been found in the current study. While depression, hostility, and anger-in are each distinct constructs, they are similar. All three have a cognitive component of suppressing feelings and internal anger. It is possible that all three tap into a common construct of negative emotional repression that influences glycemic control. The HgA_{1c} was the only dependent variable to be related to any of the psychosocial variables when only those participants who were glucose intolerant were included in the analysis.

Both the 2-hour glucose and the fasting glucose test loaded with the depression variable when all participants were included in the analysis. These measures are more state measures of glucose control than HgA_{1c}, but are widely used clinically. Psychological variables did not load when only those participants with abnormal glucose tolerance were included in the analyses. It is possible that because of a fairly large number of outliers, that some other phenomenon, other than psychosocial variables, had an impact on the glucose levels. Once again, the actual amount of variance accounted for was quite small with these findings. While a relationship was found between glycemic control and psychosocial variables, the issue of causality was unclear. Further research is needed in this area in order to determine if poor glycemic control causes a poor psychological outcome, or whether psychosocial variables directly impact glycemic control.

Hypothesis #3

The third hypothesis addressed the relationship between the psychosocial variables and the perceived outcomes of physical health and mental health. Because the SF-36 was considered a diabetic outcome measure, only those individuals with impaired glucose tolerance or who were diabetic were included in the analysis. The perceived PCS was related to the social support variable. This was a logical finding, based on the fact that those individuals with adequate social support were more likely to be able to get treatment, were less likely to be depressed and have help implementing the diabetic regimen, and it was consistent with other findings regarding the relationship between social support and diabetes (Cox & Gonder-Frederick, 1992; Leichter & Archer, 1991).

The MCS variable was related to the depression and perceived stress variables. This was expected, because the SF-36 was designed to report a participant's perceived mental health. It is possible that the SF-36 may be a useful screener for accessing psychosocial issues among a diabetic population. If a person scores significantly low on the SF-36 MCS, clinicians might want to refer the patient to the appropriate services.

One of the primary questions that this study was unable to address was that of directionality. It is unlikely that psychosocial factors have a direct contribution to the onset of diabetes, where type-2 diabetes is the increase of insulin resistance. Psychosocial factors could contribute to the onset via several indirect paths. First, one of the signs and symptoms of clinical depression is a significant change in weight. Often, depression can lead to a very sedentary lifestyle in which exercise and proper diet are not included. Obesity is one of the highest predictors of the onset of diabetes. Another factor that is highly negatively related with depression is social support. This factor was especially important in the population of this study. This study consisted primarily of Native American elders who live in more rural areas than the mainstream culture. The South Dakota participants were especially in remote sites. The lack of social support could contribute to difficulties in attaining proper access to care and proper nutrition, and place individuals at a higher risk for other psychological problems.

The second question with directionality concerned the impact on those participants who already had either impaired glucose tolerance or diabetes mellitus. Does the psychosocial variable impact diabetic outcome or is psychological status a result of a chronic illness? This cannot be answered in this study. The fact that a relationship was found indicates that further prospective research is needed. Regardless of the answer, it appears that there is justification for psychosocial screening among Native Americans with diabetes in order to increase the individual's overall quality of life. There also appeared to be enough evidence found in the literature to suggest that psychosocial factors do play a role in diabetic outcome (Cox & Gonder-Frederick, 1992; Helz & Templeton, 1990; Mazze et al., 1984; Rubin & Peyrot, 1994; Schlenk & Hart, 1984; Surwit & Schneider, 1993).

Implications

One of the most striking features of this study was that over half of the participants at both centers were either diagnosed with diabetes or had impaired glucose tolerance. This fact alone had enormous implications for both this population and for the United States as a whole. Those individuals who are in this category are at a serious risk for cardiovascular disease, stroke, renal failure, blindness, and lower limb amputation. All of these complications, which have been directly linked to diabetes, are catastrophic, each in themselves. It is not uncommon for individuals suffering from diabetes to have multiple complications. This is painful not only for the individuals themselves, but also for the families of the person with diabetes, who have watched their loved ones deteriorate as they care for and support them. In some cases, this could contribute to a feeling of learned helplessness, where the feeling of "I know I'm going to get it and there is nothing I can do about it" could prevent individuals from taking the precautions to abort the onset of type-2 diabetes. This is the human cost of diabetes that Native Americans are paying at a rate no population can afford. The logistical and economic strain this puts on the IHS, which struggles to provide adequate services to Native people, is enormous. The overall costs of diabetes in terms of human, emotional, and financial costs are significant for the general population and epidemic for the tribes in the current study. Anything that can be done to lower diabetic prevalence and improve diabetic outcome is needed in this population.

One of the most important questions to be addressed in this study was, are psychosocial variables related to diabetes? The answer appears to be "yes," but modestly. Hostility, the personality trait of keeping anger in, and depression did show a relationship to glucose control measures. Hostility is a known risk factor for cardiovascular disease. Diabetes mellitus is also a major risk factor for heart disease. There have been successes in changing this personality variable with psychological intervention (Billings, Scherwitz, Sullivan, Sparler, & Ornish, 1998). Possibly this type of intervention would not only contribute to fewer diabetic complications, but it would likely reduce the risk for cardiovascular events and increase the person's overall quality of life. Depression is often mentioned as having a relationship to glycemic control and other diabetic outcome variables, but very few actual studies are found in the literature. This study did find a relationship between depression and glycemic control. While this disease is often associated with chronic illnesses, it frequently goes untreated because the chronic illness itself is the focus of attention. If it is detected, it is usually very treatable, either through medical intervention or psychological intervention, or a combination of the two.

These findings have implications for treatment. Health care providers should be made aware of the high co-occurrence of psychological problems among at-risk and diabetic patients. Screening for psychological issues such as depression, social support, hostility, and anger should be included in clinic visits with this population.

Subsequently, these psychosocial issues could also be treated, either through psychological, medical, or community-based interventions. These interventions could potentially have an impact on diabetes through two different avenues. The first is the possibility of there being a direct correlation between psychosocial factors and glycemic control. If such a relationship exists at a clinical level, psychosocial intervention could lead to better glycemic control, which in turn lowers the risk for complications among persons with diabetes. The second avenue is an indirect relationship, where improving an individual's overall mental health could lead to healthier behaviors that lower the risk of contracting diabetes or lower the risk of complications. For example, improved mental health may give a person more energy to exercise or make the diabetic diet seem like less of an obstacle.

Limitations

Limitations of the current study should be noted. While the overall sample size of the study was 512 participants, some factors of the design may have decreased the statistical power of the analyses. Of particular importance is the fact that analyses that include only those participants who were glucose intolerant decreased the sample size by roughly 50% and also restricted the range of scores on several variables. Additionally, it is possible that due to multicolinearity among many of the psychosocial variables, their ability to enter the regression equations was compromised.

Many of the instruments used were modified in order to be culturally sensitive. This balance is important, but it does come with a price. First, the validity of these revised measures is unknown. Second, while this study can address trends within the sample, many comparisons from the instruments used could not be made against the national established norms.

This study is correlational and cross-sectional by nature. Therefore, no statements about causation can be made. It can be stated that there is a relationship between certain psychosocial variables, and both physiological glycemic measures and perceived outcome in this sample of participants. Becausee this study is cross-sectional, it is uncertain if the negative psychosocial scores are predictive of or caused by diabetic variables. In the future, an attempt should be made to look at longitudinal data within this population in order to establish the predictive ability of psychosocial variables diabetic outcome.

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APPENDICES

Appendix A: Data Request

STRONG HEART STUDY

REQUEST FOR DATA

Title of project:Psychosocial Factors and Their Relationship to Non-insulin Dependent Diabetes Mellitus dependent among the Strong Heart Study Cohort.

Investigators:	Brian O'Leary, BS	Utah State University
	Kevin Masters, Ph.D.	Utah State University

Purpose: Other, for completion of thesis
(Will consult the Strong Heart Study for approval before any submission for journal publication)

Date Needed: 09 / 15 / 99 (mm dd yy) **(please allow 1-2 weeks form data request received)**

Data for Study Period: ____ Phase - I ____ Phase - II X Both

Center: ____ Arizona X Oklahoma X South/North Dakota ____ All 3 Centers

Variables Needed: List all the variables)

I am requesting the data on the following individuals who participated in the psychosocial pilot study in the Oklahoma and South Dakota sites.

I request all of the variables raw and derived on the following protocols

CES-D
COOK Medley (HO)
Spielberger AX
ISEL
Cultural Factors Questionnaire

Individual Variables

<u>Personal Interview Form I</u>

INDO
CC
BIRTHDAY

<u>Personal Interview Form II</u>

Tobacco Derived Variables
Weight DVs
Alcohol DVs
Perceived Stress DVs
Physical Activity DVs
INT22_40
INT22_41
INT22_51
INDO

DATA REQUEST Continued:

Medical History	Physical Examination	Diabetic Foot Screen
INDO	INDO	INDO
Fasting and 2 Hour Glucose	EX2_7	Derived Diabetic Foot Variables
Hemoglobin A_{1C}	EX2_8	
MED2_8	EX2_9	
MED2_9	Waist Measurement	
MED2_10	Weight to Hip ratio	
MED2_11	Derived BMI	
MED2_12	Hypertension Status & Treatment	
MED2_13	SBP	
MED2_15	DBP	
MED2_16	BP DVs	
MED2_17		
MED2_18		
Diabetic Status		
Diabetic Treatment Variable		

Risk Factors Questionnaire

IDNO
RISK5
RISK6
RISK7

****

COORDINATING CENTER USE ONLY:

Date Received: ____________________

Date Data Delivered: ____________________

Appendix B: Variable Explanation

Variables were requested for only those participants who participated in the psychosocial pilot study.

All raw and derived variables were requested for:

CES-D
COOK Medley (HO)
Spielberger AX
ISEL
Cultural Factors Questionnaire

Personal Interview Form:

INDO:	Study ID Number, stable across phases
CC:	Community Code
BIRTHDAY:	Participants' date of birth

Personal Interview Form II:

INT22_1	Marital Status
Tobacco Derived Variables	*Derived Variable are the being used at the request of*
Weight Derived Variables	*Strong Heart Study. An explanation of the variables*
Alcohol Derived Variables	*How they were derived was requested and will come*
Perceived Stress Derived Variables	*with the data set.*
Physical Activity Derived Variables	
INT22_40	Boarding School
INT22_41	Years of Boarding School
IDNO	ID Number
INT22_51	Household Income

Medical History:

Fasting Glucose and 2 hour glucose level
Hemoglobin A_{1C}

INDO	ID Number
MED2_8	Control diabetes by Insulin
MED2_9	Oral Hypoglyc
MED2_10	By Dietary Control
MED2_11	By Exercise
MED2_12	Nothing
MED2_13	Kidney Failure
ESRD Derived variables	
MED2_15	How old for KF
MED2_16	Renal Dialysis
MED2_17	Kidney Transplant
MED2_18	Cirrhosis

Diabetic Status Variable
Diabetic Treatment Variable (from Medication form)

Appendix B con.

Physical Examination:

INDO	ID Number
EX2_7	Height
EX2_8	Weight
EX2_9	Height
Waist measurement	
Weight to Hip ratio	
Derived BMI	Body Mass Index
Hypertension status & Treatment	
SBP	Systolic BP
DBP	Diastolic BP
BP derived Variables	

Diabetic Foot Screen:

IDNO	ID Number
Derived Diabetic Foot Variable	Score for foot screen

Risk Factor Questionnaire:

IDNO	ID Number
RISK5	Is Diabetes a risk factor for heart disease?
RISK6	Worry, Anxiety or Stress Risk
RISK7	Being Overweight

Appendix C: Data Set Management Records

This is a working document where I record every adjustment I make to the data set so you can ensure what I do is producing accurate data.

- Merged all files; Menu Data: Select Merge Files: Add Variables, save as All Variables File

Variables were entered as strings, changed to numeric value and ordinal scale.

Perceived Stress Variable

- Items int22_32, int22_33, int22_ 35 were reversed scored
5=1, 4=2, 3=3, 2=4, 1=5

Computed scores Total: Transform: Compute:
int22_30 + int22_31 + int22_34 + int22_36 + int32_r + int33_r + int35_r = Prestress

Spielberger AX Scales

- Speilberger AX Scale, Reverse score items 2, 4, 6, 7, 9, 11,13, 15,16, 17, 19, New variable names are same as old except with a R after (Spiel2R). Reversed scored by Menu Transform: Recode: In different Variable: Old and new values : 1=4, 2=3, 3=2, 4=1

Computed scores Total: Transform: Compute: spiel3 + spiel5 + spiel8 + spiel10 + spiel12 + spiel14 + spiel18 + spiel20 + spiel21 + spiel2r + spiel4r + spiel6r + spiel7r + spiel9r + spiel11r + spiel13r + speil15r + spiel16r + spiel17r + spiel19r = Axtot

Compute scores Anger-In: Transform: Compute:
spiel4r + spiel6r + spiel7r + spiel9r + spiel11r + spiel13r + speil15r + spiel16r + spiel17r = Angerin

Compute scores Anger-Out: Transform: Compute
spiel3 + spiel8 + spiel10 + spiel12 + spiel14 + spiel18 + spiel20 + spiel21=Angerout

The possible ranges for these scales are as follows :

Total 20 - 80
Angerin 8-32
Angerout 8-32

Cook Medley

Compute scores Cmtot: Transform: Compute: cook2 + cook3 + cook4 + cook5 + cook6 + cook7 + cook8 + cook9 = Cmtot

There were no reversed scores on this, possible range 0-8

Interpersonal Support Evaluation List (ISEL)

Items 4, 9, and 14 were reversed scored: 0=3, 1=2, 2=1, 3=0, and were labeled with a r to indicate reversal of item.

Compute scores IselTot: Transform: Compute:
isel2 + isel3 + isel5 + isel6 + isel7 + isel8 + isel10 + isel11 + isel12 + isel13 + isel15 + isel16 + isel17 + isel18 + isel19 + isel20 + isel21= Iseltot

Center for Epidemiological Studies Depression Scale (CES-D)

Items 5, 9, 13, & 17 were reversed scored: 1=4, 2=3, 3=2, 4=1, , and were labeled with a r to indicate reversal of item.

Compute scores Cesdtot: Transform: Compute:
ces2 + ces3 + ces4 + ces6 + ces7 + ces8 + ces10 + ces11 + ces12 + ces14 + ces15 + ces16 + ces18 + ces19 + ces20 + ces22 + ces5r + ces9r + ces13r + ces17r = cesdtot

SF-36 Health Survey

It seems from reading the manual that there is not a "total score" for the SF-36, but rather just the subscales. I will visit about this with you about which specific subscales we will use. But I will calculate them all just to have.

The SF-36 to subscales are scored so that a higher score indicates a better health state.

The items for the specific subscales are as follows:

(I will put an explanation of all these scales in the draft)
Physical Functioning: 3, 4, 5, 6, 7, 8. 9, 10, 11, 12
Role-Physical: 13, 14, 15, 16
Bodily Pain: 21, 22
General Health: 1, 33, 34, 35, 36
Vitality: 23, 27, 29, 31
Social Functioning: 20, 32
Role-Emotional: 17, 18, 19
Mental Health: 24, 25, 26, 28, 30
Reported Health Transition: 2

There is several items that need to be recoded as per the manual:

The first variable is the sum of the weighted scores. The second is the scaled score, which is:

Transformed score = { (actual score-lowest possible score) / Possible raw score range} x 100

Physical Functioning: 3, 4, 5, 6, 7, 8. 9, 10, 11, 12

Computed as: qua3 + qua4 + qua5 + qua6 + qua7 + qua8 + qua9 + qua10 + qua11 + qua12= pf
Scaled score: ((pf - 10) / 20) * 100 =pfs

This scale is directly scored,
The non-scaled variable is pf
Lowest possible: 10
Possible raw score: 20
The scaled variable is pfs

Role-Physical: 13, 14, 15, 16

Computed as: qua13 + qua14 + qua15 + qua16=rp
Scaled Score: ((rp - 4) / 4) * 100 = rps

This scale is directly scored
The non-scaled variable is rp
Lowest possible: 4
Possible raw score: 4
The scaled variable is rps:

Bodily Pain: 21, 22
Computed as: qua21r + qua22r = bp
Scaled scale: ((bp - 2) / 10) * 100 = bps

Item 21: 1=6, 2=5.4, 3=4.2, 4=3.1, 5=2.2, 6=1
Item 22: If 22 is 1 and 21 is 1 = 6 If 22 is 1 and 21 is 2 through 6 = 5
2 = 4, 3=3, 4=2, 5=1
This was done in syntax as follows:

```
DO IF (qua22 = 1 AND qua21>1) .
 COMPUTE qua22r = 5 .
ELSE IF (qua22 = 1 AND qua21 = 1) .
 COMPUTE qua22r = 6 .
ELSE IF (qua22 = 2 AND qua21 >= 1) .
 COMPUTE qua22r = 4 .
ELSE IF (qua22 = 3 AND qua21 >= 1) .
 COMPUTE qua22r = 3 .
ELSE IF (qua22 = 4 AND qua21 >= 1) .
```

COMPUTE qua22r = 2 .
ELSE IF (qua22 = 5 AND qua21 >= 1) .
COMPUTE qua22r = 1 .
END IF .

The non-scaled variable is: bp
Lowest possible: 2
Possible raw score: 10
The scaled variable is: bfs

General Health: 1, 33, 34, 35, 36

Computed as: qua33 + qua36 + qua1r + qua34r + qua35r =gh
Scaled score: ((gh - 5) / 20) * 100=ghs

Item 1: 1=5, 2=4.4, 3=3.4, 4=2, 5=1
Items 33 & 36, Directly scored
Items 34 & 35: 1=5, 2=4, 3=3, 4=2, 5=1
The non-scaled variable is gh
Lowest possible: 5
Possible raw score: 20
The scaled score is: ghs

Vitality: 23, 27, 29, 31

Computed as: qua29 + qua31 + qua23r + qua27r = v
Scaled score: ((v - 4) / 20) * 100 = vs

Items 29 & 31 are directly scored
Items 23 & 27 are 1=6, 2=5, 3=3, 4=4, 5=2, 6=1

The non-scaled variable is v
Lowest possible: 4
Possible raw score: 20
The scaled score is: vs

Social Functioning: 20, 32
Computed as: qua32 + qual20r = sf
Scaled score: ((sf - 2) / 8) * 100 = sfs

Item 32 is directly scored
Item 20 is: 1=5, 2=4, 3=3, 4=2, 5=1

The non-scaled variable is sf

Lowest possible: 2
Possible raw score: 8
The scaled score is: sfs

Role-Emotional: 17, 18, 19

Computed as: qua17 + qua18 + qua19 =re
Scaled score: ((re - 3) / 3) * 100 = res

All items are directly scored

The non-scaled variable is re
Lowest possible: 3
Possible raw score: 3
The scaled score is: res

Mental Health: 24, 25, 26, 28, 30

Computed as: qua24 + qua25 + qua28 + qua26r + qua30r = mh
Scaled score: ((mh - 5) / 25) * 100

Items 24, 25, & 28 are directly scored
Items 26 & 30: 1=6, 2=5, 3=3, 4=2, 6=1

The non-scaled variable is mh
Lowest possible: 5
Possible raw score: 25
The scaled score is mhs

Reported Health Transition: 2
Not scored as a subscale, but used are an independent variable to assess changes in health

SF-36 Composite scores

PF_Z =	(pfs - 84.52404) / 22.89490
RP_Z =	(rps - 81.19907) / 33.79729
BP_Z =	(bps - 75.49196) / 23.55879
GH_Z =	(ghs - 72.21316) / 20.16964
VT_Z =	(vs - 61.05453) / 20.86942
SF_Z =	(sfs - 83.59753) / 22.37642
RE_Z =	(res - 81.29467) / 33.02717
MH_Z =	(mhs - 74.84212) / 18.01189

Agg_phys = (pf_z* .42402) + (rp_z * .35119) + (bp_z * .31754) + (gh_z * .24954) + (vt_z *.02877) + (sf_z * -.00753) + (re_z * -.19206) + (mh_z * -.22069)

$$Agg\_ment = (pf\_z * -.22999) + (rp\_z * -.12329) + (bp\_z * -.09731) + (gh\_z * -.01571) + (vt\_z * .23534) + (sf\_z * .26876) + (re\_z * .43407) + (mh\_z * .48581)$$

$$PCS = 50 + (agg\_phsy * 10)$$

$$MCS = 50 + (agg\_ment * 10)$$

Appendix D: Strong Heart Phase II

Protocols

THE STRONG HEART STUDY II
CES-D SCALE

1. How was the questionnaire administered? ____
   1=By interviewer, 2=By self, 3=Refused

Here are some questions (Q2-Q21) about your feelings during the past week. For each of the following statements, please respond as to whether you felt that way: Rarely or Not At All, Some of the time, Often, or Most of the Time. This is a measure of your feelings so there are no right or wrong answers. If you do not understand a question, answer it how you best understand the question.

1	2	3	4	9
Rarely or Not at All	Some (1-2 days)	Often (3-4 days)	Most of the Time (5-7 days)	Not Applicable

During the **past week....**

2. I was bothered by things that don't usually bother me. ____
3. I did not feel like eating, my appetite was poor. ____
4. I felt that I could not shake the blues even with help from my family or friends. ____
5. I felt that I was just as good as other people. ____
6. I had trouble keeping my mind on what I was doing. ____
7. I feel depressed. ____
8. I felt that everything I did was an effort. ____
9. I felt hopeful about the future. ____
10. I thought my life had been a failure. ____
11. I felt fearful. ____
12. My sleep was restless. ____
13. I was happy. ____
14. I talked less than usual. ____
15. I felt lonely. ____
16. People were unfriendly. ____

17. I enjoy life. ____

18. I had crying spells. ____

19. I felt sad. ____

20. I felt that people dislike me. ____

21. I felt that people disliked me. ____

For Question 22, please use the following scale

1	2	3	4	9
Rarely or Not at All	Some	Often	Most of the Time	Not applicable

22. I have felt depressed or sad in the **past year**.

____

23. Interviewer's code: ____

24. Date completed (mo/day/yr) ____/____/____

THE STRONG HEART STUDY II
SPIELBERGER - AX

1. How was the questionnaire administered? ____
1=By interviewer, 2=By self, 3=Refused

A number of statements which people have used to describe themselves when they feel angry or furious are given below (Q2-Q21). Please read each statement and then indicate how often you feel or act in the manner describe when you are angry. This is a measure of your feelings; so there are no right or wrong answers.

0	1	2	3
Rarely Or Never	Sometimes	Often or Always	Almost Always

When I feel angry....

2. I control my temper. ____
3. I express my anger. ____
4. I keep my feelings to myself. ____
5. I make threats I don't really mean to carry out. ____
6. I withdraw from people when I'm angry. ____
7. I give people "the silent treatment" when I'm angry. ____
8. I make hurtful remarks to others. ____
9. I keep my cool. ____
10. I do things like slam doors when I'm angry. ____
11. I boil inside, but don't show it. ____
12. I argue with others. ____
13. I hold grudges that I don't tell anyone about. ____
14. I strike out (emotionally or physically) at whatever makes my angry. ____
15. I am more critical of (judge or find fault with) others than I let people know. ____
16. I get angrier than I usually admit. ____
17. I calm down faster than most people. ____
18. I say mean things. ____
19. I am irritated (frustrated, annoyed) much more than people are aware of. ____
20. I lose my temper. ____

21. If someone bothers (frustrates, irritates) me, I am likely to tell him/her. ___

22. Interviewer's code: ___

23. Date completed (mo/day/yr) ___/___/___

THE STRONG HEART STUDY II
COOK MEDLEY

1. How was the questionnaire administered? ____
1=By interviewer, 2=By self, 3=Refused

These next questions (Q23- Q30) are about how you think about other people. Although we cannot really know what people would think or do unless they tell us, we would like to know you opinion as to whether you think each of the following statements is "True or False". Once again, this is your opinion, so there is no right or wrong answer.

0	1
True	False

2. No one cares much about what happens to me. ____
3. It is safer to trust nobody. ____
4. Most people would lie to get ahead. ____
5. Most people inwardly dislike putting themselves out to help other people. ____
6. Most people will use unfair means to gain an advantage rather than lose it. ____
7. Most people are honest mainly through fear of being caught. ____
8. I often wonder what hidden reason another person may have for doing something nice for me. ____
9. Most people make friends because friends are likely to be useful to them. ____
10. Interviewer's code ____
11. Date completed (mo/day/yr) ____ ____ ____

THE STRONG HEART STUDY II
ISEL

1. How was the questionnaire administered? ____
   1=By interviewer, 2=By self, 3=Refused

This scale is an assessment of social support, and is made up of a list of statements, which ma or may not be true about you. For each statement (Q2-21), answer as to whether it is 'Never True', 'Rarely True', 'Somewhat True', or 'Definitely True' for you.

0	1	2	3
Never True	Rarely True	Somewhat True	Definitely True

2. If I needed a quick emergency loan of $30, there is someone I could get it from. ____
3. There is at least one person I know, whose advice I really trust. ____
4. If I needed help around the house (that is, with cleaning or making small repairs), I would have a hard time finding someone to help me without pay. ____
5. If I wanted to go play bingo, go to a potluck or pow wow, or some other activity, I could easily find someone to go with me. ____
6. I have a positive attitude about myself. ____
7. When I need suggestions for how to deal with a personal worry or problem I know there is someone I can talk to. ____
8. There are several people that I regularly enjoy spending leisure time with. ____
9. There is really no one I can talk to about money problems. ____
10. I have the confidence to do the things I want to do in my life. ____
11. If I needed help in doing some errands, I could find someone to help me. ____
12. I am a person of at least equal worth as other people. ____
13. I know someone that I can talk with about my most private thoughts and feelings. ____
14. If I needed a ride early in the morning, I would have a hard time finding anyone to take me. ____
15. I often meet or talk with friend or members of my family. ____
16. I am basically a good person. ____
17. I often get invited to do things. ____
18. I feel satisfied with the help I get in doing tasks around the house, taking care of errands, and getting rides. ____
19. I feel satisfied with the amount of support I get with personal concerns. ____

20. I feel satisfied with how often I talk to, or get together with family and friends. ____

For each statement (Q2-21), answer as to whether it is 'Never True', 'Rarely True', 'Somewhat True', or 'Definitely True' for you.

0	1	2	3
Never True	Rarely True	Somewhat True	Definitely True

21. I feel satisfied with how I feel about myself. ____

22. Interviewer's code ____

23. Date completed (mo/day/yr) ____ ____ ____

THE STRONG HEART STUDY – PHASE II
CARDIOVASCULAR DISEASE IN AMERICAN INDIANS

PERSONAL INTERVIEW FORM II

ID number ______
Social Security Number ____ ____ ____

(items from the perceived stress scale on Personal Interview II)

E. Perceived Stress

In the past month, how often have you (questions 32-38):
(1=not at all 2=Rarely 3=Sometimes 4=Often 5=Most of the time)

32. been upset because something that happened unexpectedly? ____

33. felt nervous or "stressed"? ____

34. dealt well with irritating life hassles? ____

35. felt that things were going your way? ____

36. felt unable to control irritations in your life? ____

37. felt that you were on top of things? ____

38. felt difficulties or problems were piling up so high that you could not handle them? ____

THE STRONG HEART STUDY II
Quality of Life

How was the questionnaire administered? (1=By interviewer, 2=By self, 3=Refused) ___

1. In general, would you say your health is: **(Circle One Number)**

Excellent	1
Very Good	2
Good	3
Fair	4
Poor	5

2. **Compared to one year ago**, how would rate you health in general now?**(Circle One Number)**

Much better now than one year ago	1
Somewhat better now than one year ago	2
About the same	3
Somewhat worse than one year ago	4
Much worse than one year ago	5

The following items are about activities you might do doing a typical day. Does **your health now** limit you in these activities? If so, how much?

(Circle One Number on Each Line)

3.	**Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports.	1	2	3
4.	**Moderate activities**, such as moving a table, pushing a a vacuum cleaner, bowling, or playing golf.	1	2	3
5.	Lifting or carrying groceries.	1	2	3
6.	Climbing **several** flights of stairs.	1	2	3
7.	Climbing **one** flight of stairs.	1	2	3
8.	Bending, kneeling, or stooping.	1	2	3
9.	Walking **more than a mile**.	1	2	3
10.	Walking **several blocks**.	1	2	3
11.	Walking **one block**.	1	2	3
12.	Bathing or dressing yourself.	1	2	3

Questions adopted from the RAND 36-Item Health Survey 1.0.

During **the past 4 weeks**, heave you had any of the following problems with you work or other regular daily activities **as a result of you physical health**?

(Circle One Number on Each Line)

		Yes	No
13.	Cut down the **amount of time** you spent on work or other activities.	1	2
14.	**Accomplished less** than you would like.	1	2
15.	Were limited in the kind of work or other activities.	1	2
16.	Had **difficulty** performing the work or other activities (for example, it took extra effort)	1	2

During the **past 4 weeks**, have you had **any** of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?

(Circle One Number on Each Line)

		Yes	No
17.	Cut down the **amount of time** you spent on work or other activities.	1	2
18.	**Accomplished less** than you would like.	1	2
19.	Didn't do work or other activities as **carefully** as usual.	1	2

20. During the **past 4 weeks**, to what extent has you physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

(Circle One Number)

Not at all	1
Slightly	2
Moderately	3
Quite a bit	4
Extremely	5

21. How much **bodily** pain have you had during the **past 4 weeks**?

(Circle One Number)

None	1
Very mild	2
Mild	3
Moderate	4
Severe	5
Very severe	6

22. During **the past 4 weeks**, how much did pain interfere with your normal work (including both work outside the home and housework).

(Circle One Number)

Not at all	1
A little bit	2
Moderately	3
Quite a bit	4
Extremely	5

These questions are about how you feel and how things have been with you during the **past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the **past 4 weeks**. **(Circle One Number on Each Line)**

		All of the Time	Most of the Time	A Good Bit of the Time	Some of the	A Little of the Time	None of the TimTime
23.	Did you feel full of pep?	1	2	3	4	5	6
24.	Have you been a very nervous person?	1	2	3	4	5	6
25.	Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
26.	Have you felt calm and peaceful?	1	2	3	4	5	6
27.	Did you have a lot of energy?	1	2	3	4	5	6
28.	Have you felt downhearted and blue?	1	2	3	4	5	6
29.	Did you feel worn out?	1	2	3	4	5	6
30.	Have you been a happy person?	1	2	3	4	5	6
31.	Did you feel tired?	1	2	3	4	5	6

32. During the **past 4 weeks**, how much of the time has your **physical health** or **emotional problems** interfered with your social activities (like visiting friends, relatives, etc.)?

	(Circle one Number)
All of the time	1
Most of the time	2
Some of the time	3
A little bit of the time	4
None of the time	5

How TRUE or FALSE is each of the following statements for you?

(Circle One Number on Each Line)

		Definitely True	Mostly True	Don't True	Mostly True	Definitely True
33.	I seem to get sick a little easier than other people.	1	2	3	4	5
34.	I am as healthy as anybody I know.	1	2	3	4	5
35.	I expect my health to get worse.	1	2	3	4	5
36.	My health is excellent.	1	2	3	4	5

37. Interviewer's code ___ ___ ___

38. Date (mo/day/yr) ___ ___/___ ___/___ ___